Space Weather Technical Forecast

Issued on Tuesday, 26 July 2022 at 13:04 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity is currently Very Low, with only low B-class flares observed. This is despite nine active regions on the Earth-facing disc, seven of which are numbered. The most active regions were AR3060 Axx/alpha near the northwest limb, and a new region Cao/Beta that rotated onto the northeast limb. AR3065 Cri/Beta is the only other region of note, with some intermediate spot growth, whilst all other regions remained small and simple. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds measured by DSCOVR and ACE were mainly slightly elevated to background, but potentially saw a weak transient move through early on the 26th. The speed remained slightly elevated at near 400km/s, with a brief but uncertain increase to 500km/s 26/0400-0530 UTC. Density was at or below average. The interplanetary magnetic field (IMF), Bt, was at 5-7nT, however the Bz rotated from positive (northward) to peak negative values (southward) from 25/1200-26/0200 UTC, before becoming mostly positive from 26/0230 UTC, then negative again 26/0930 UTC. This ranged from +4nT to -5nT. The Phi angle remained negative (towards the Sun). Geomagnetic activity was mostly Quiet, but had one Unsettled interval (Kp3) at 26/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES16 was at Background levels. The High energy electron flux (greater than 2MeV) varied between Normal Background and High levels, with a peak of 1250pfu observed at 25/1605UTC. Electron fluence displayed a steady increasing trend but remained well below the Active threshold. An observed fluence of 5.07e7 integrated pfu was recorded at 26/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is likely to remain Very Low to Low with only a slight chance of M-class flares despite the large number of sunspots on the Earth-facing disc, as these are currently all small and simple. There is the potential for far-side regions to rotate onto the disc by the end of the period, and increasing this risk

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Slightly elevated solar winds are likely to ease to background. There is a chance of slight enhancements on day 2 (27th) or early day 3 (28th) from the arrival of a weak coronal hole fast wind, along with a further slight enhancement possible late day 4 (29th) due to the arrival of the fast wind of CH04/-. Mainly Quiet geomagnetic activity is expected, with a chance of Unsettled intervals. Fast wind arrival late day 4 (29th) may increase activity to Active with a very slight chance of G1/Minor Storms.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to vary between Background and Moderate levels, with only a chance diurnally of increasing to High (greater than 1000 pfu). The 24 hour fluence is expected to remain below the Active level, with only a very slight chance of rising above by the end of day 2 (27th).

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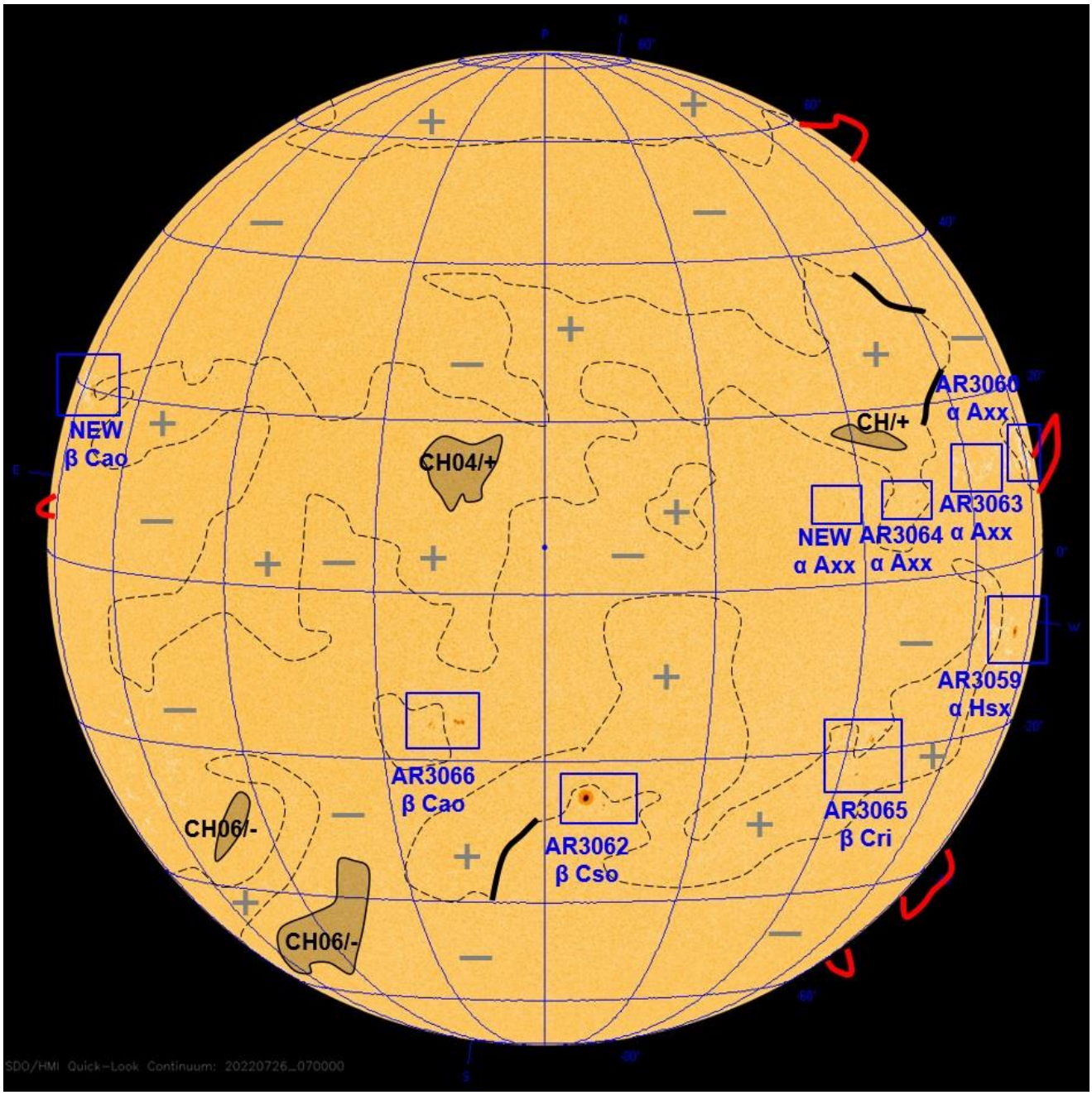
Figure 1. Solar Analysis Valid 26/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

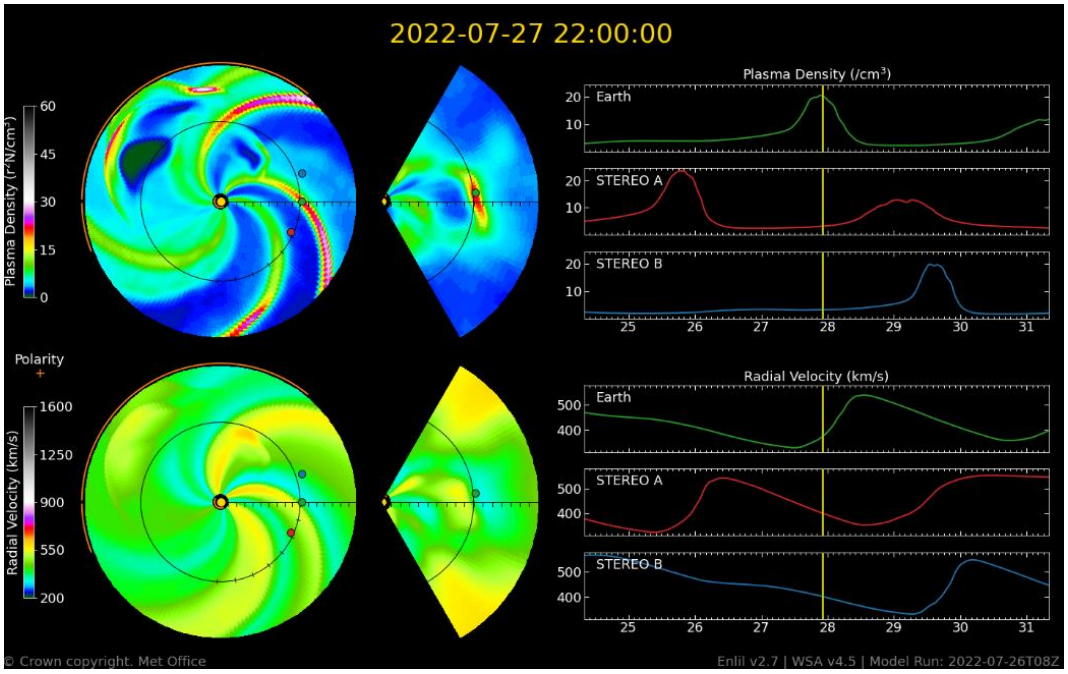
No CMEs have been assessed as Earth-directed for this period.

Solar winds are currently slightly elevated, and expected to gradually ease through the period, but potentially with a small enhancement possible later on day 4 (29th) from CH04. Any enhancement from the unnumbered coronal hole in the northwest disc is most likely on day 2 (27th) or early day 3 (28th) and expected to remain minimal. Enlil suggests a notable enhancement on the 28th, however this is currently expected to be too soon to be the arrival of the fast wind of CH04, which is supported by the lack of any such enhancement being evident at STEREO A.

Geomagnetic activity is forecast to be mainly Quiet, with a chance of Unsettled intervals. There is a chance of increasing to Active, with an outside chance of G1/Minor storms towards the end of day 4 (29th), but more likely just beyond the forecast period (day 5)

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil showing enhancement late 27th and 28th that is currently not expected.



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Radio Blackouts - X-Ray Flares:

Solar Activity is currently Very Low, with only B-flares observed in the last 24 hours. This is despite nine active region on the visible disc, seven of which are numbered. These regions are generally small, and either stable or showing signs of decay. The most prominent regions are AR3065 in the southwest (Cri/Beta) and a region that is unnumbered by recently rotated onto the disc (Cao/Beta).

There are a significant number of region on the far-side, as indicated by heliosiesmic products, and these have the potential to increase flare probabilities later in the period, however confidence is Low that these will persist as they rotate onto the disc.

Given the small size, and lack of significant growth of any region on the Earth-facing disc Very Low to Low activity is currently expected to persist, with only a slight chance of rising to Moderate.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/17 X-ray flux

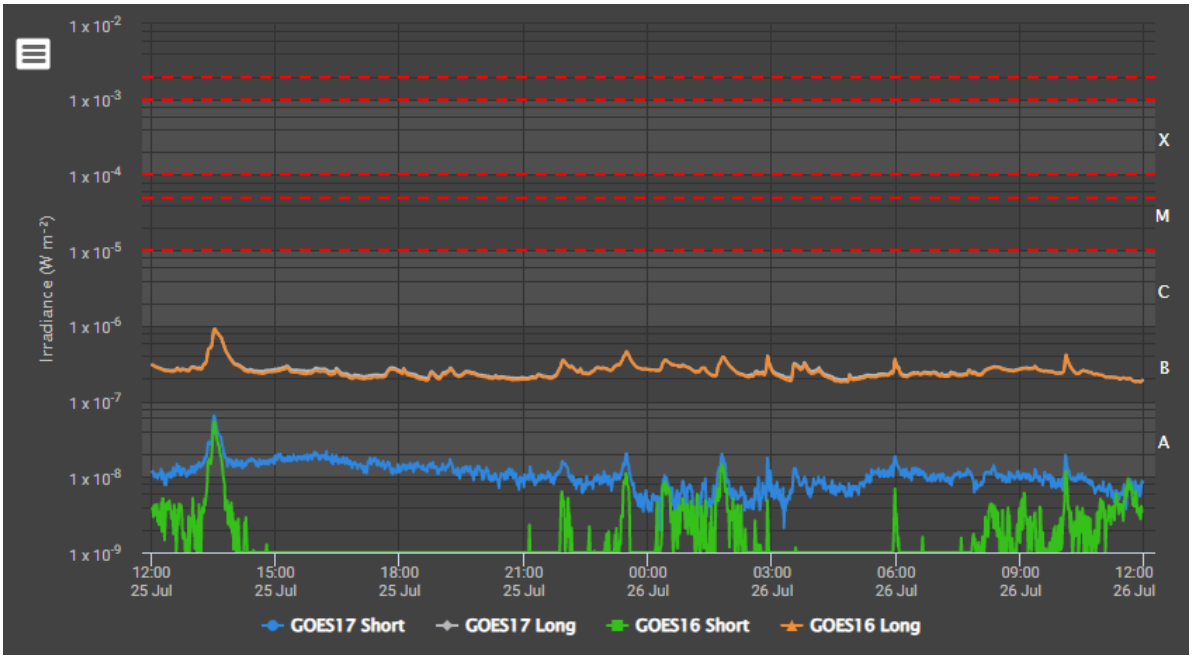

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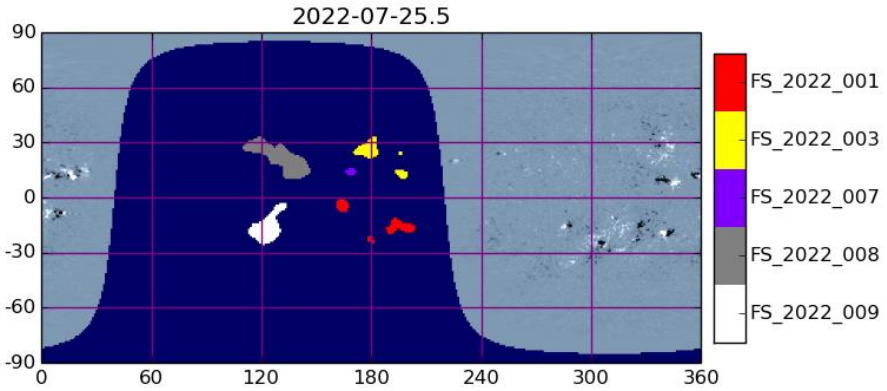
Figure 4: Heliosiesmic data of the far-side (from jsoc.stanford.edu), showing potential number of far-sided regions to rotate onto the disc.



Designation	Centroid Longitude (degree)	Centroid Latitude (degree)	Strength	ETA at East Limb (yyyy-mm-dd.d)	Days from East Limb
FS-2022-001	184.1	-13.8	408	2022-07-27.8	2.8
FS-2022-003	180.4	24.0	448	2022-07-27.8	2.8
FS-2022-007	168.6	13.4	64	2022-07-28.7	3.7
FS-2022-008	132.3	19.9	1511	2022-07-31.5	6.5
FS-2022-009	123.1	-16.8	1202	2022-08-01.4	7.4

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has exhibited a declining trend despite recent solar wind enhancements. There is still the potential for flux levels to rise a little through the period, with solar winds easing and no further notable enhancements expected. Consequently Background to Moderate levels are expected to persist, with a daily chance of peaking at High.

The associated 24 fluence is expected to remain below the Active threshold, with only a very slight chance of rising above, as whilst briefly High levels are expected, these flux values are unlikely to be persistent. This is supported by REFM.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MeV Electron Flux (top) and Fluence with REFM and 27-day persistence (bottom)

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